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ABSTRACT

This paper asserts that the perspective of "A Nation at Risk" has distorted the nation's understanding of the relationship between education and the economy for two decades. Written during a recession, it implied that the state of the economy could be directly traced to the current performance of the nation's education system. However, this perspective does not distinguish between short-term swings in the business cycle and long-term trends in economic growth. The U.S. economy's ability to grow over time is partly a function of the quality of the educational system. In the past century, the U.S. led the world in expansion of its education system, contributing to its preeminence in the international economy. However, there is little evidence that the K-12 education system can be counted on to fuel economic growth in the future, because quality of schooling has become more important than just quantity or the year of schooling of U.S. students. Basic math and science skills appear especially important, but U.S. students are not competitive internationally. Other factors, such as the nation's superb colleges and universities, high immigration levels, and a well-functioning market economy have compensated for the state of the schools so far, but the economy could do even better over time if schools were improved. The costs of not improving U.S. schools are estimated to be large. (Contains 40 references and 5 figures.) (SM)

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The Importance of School Quality

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ABSTRACT

The perspective of A Nation At Risk (ANAR) has distorted the nation's understanding of the relationship between education and the economy for two decades. Written during a recession, ANAR implied that the state of the economy could be directly traced to the current performance of a nation's education system. What this perspective fails to do is to distinguish between short-term swings in the business cycle and long-term trends in economic growth. That the Japanese economy is in recession while the U.S. economy booms in any particular year says virtually nothing about the relative quality of schools in the different countries.

Our economy's ability to grow over time is importantly, but not solely, a function of the quality of our education system. In the past century, the United States led the world in the expansion of its education system, contributing to its preeminence in the international economy. However, there is little evidence that the K-12 education system can be counted on to fuel economic growth in the future, because quality of schooling – what our children learn each year – has become more important than just quantity, or the years of schooling of our students. Basic math and science skills appear especially important, but U.S. students are not competitive internationally. Other factors, such as the nation's superb colleges and universities, high levels of immigration, and a well-functioning market economy have compensated for the state of the schools so far, but the economy could do even better in the long run if the schools were improved. The costs of not improving our schools are estimated to be very large.

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The Importance of School Quality

By Eric A. Hanushek

The ideas ventured by *A Nation at Risk,* though prescient in many respects, have distorted the nation's understanding of the relationship between education and the economy for two decades now. Written during a recession, *A Nation at Risk* implied that the general state of the economy could be directly traced to the current performance of a nation's education system. The economic trends of the eighties and early nineties reinforced this interpretation. When the economies of Japan, Korea, Thailand, and other East Asian countries were growing at rates so fast that they were predicted to surpass the U.S. economy within short periods of time, the education system was often blamed for the nation's seeming loss of competitive advantage. Once the tide turned, with the United States experiencing a long burst of growth and innovation for most of the nineties while the East Asian "miracle" evaporated, the rhetorical environment was ripe for a turning of the tables. Observers who never bought *A Nation at Risk*'s thesis of mediocrity and stagnation in the nation's schools were quick to cite the nation's economic performance as evidence of a high-performing education system.

Consider Alfie Kohn, a prominent critic of academic standards and testing, who wrote in 2000:

> As proof of the inadequacy of U.S. schools, many writers and public officials pointed to the sputtering condition of the U.S. economy. As far as I know, none of them subsequently apologized for offering a mistaken and unfair attack on our educational system once the economy recovered, nor did anyone credit teachers for the turnaround.[1]

Another prominent defender of the school system, Gerald Bracey, took the argument one step further. Noting that a variety of people from before and after *A Nation at Risk* had argued for improving schools in order to maintain U.S. economic strength, he wrote, "None of these fine gentlemen provided any data on the relationship between the economy's health and the

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[1] Kohn (2000).

performance of schools. Our long economic boom suggests there isn't one—or that our schools are better than the critics claim."[2]

The fact is that the supporters and the critics of *A Nation At Risk* have woefully misinterpreted the economic trends. They have been all too eager to jump on almost any economic news and to link it to today's schools. Any pattern of bad economic results demonstrates to some that the education system is broken, while to others any good news confirms the superiority of U.S. schools. What this perspective fails to do is to distinguish between short-term swings in the business cycle and long-term trends in economic growth. It also ignores other factors that might affect both current economic conditions and overall patterns of economic growth and development. That the Japanese economy is in recession while the U.S. economy booms in any particular year says virtually nothing about the relative quality of schools in the different countries. It might instead say something about the quality of their governments' current fiscal and monetary policies. It might even bear some relationship to the skills workers learned in past decades—when the full spectrum of the labor force was attending school. But it can't tell us anything about the quality of the instruction that this year's tenth-grade class is receiving.

By contrast, an economy's ability to grow over time—its ability to innovate and to raise both productivity and real incomes—is at least in part a function of the quality of its education system. Research shows that the skills possessed by workers, while not the only input, are an increasingly important factor in economic growth. The increased importance of skills appears in its effects on the earnings of individuals and on the subsequent distribution of income in the economy. Moreover, the education system is central to the development of skills, a fact long recognized by parents, policy makers, and educators. In the past century, the United States led the world in the expansion of its education system. This expansion has contributed to the pre-eminent position of the U.S. economy in the world. Nonetheless, concerns exist about the future. There is

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[2] Bracey (2002).

little evidence that the K–12 education system in the United States is in fact competitive in the world economy or that it can be counted on to fuel future U.S. economic growth. These are matters that should be taken very seriously.

The fact that other aspects of the U.S. economy are sufficient to compensate for the mediocre quality of its schools should not be taken as justification for allowing the current state to continue. The quality of schooling has a clear impact on both individual earnings and the growth of the overall economy, and the available evidence suggests that improvements in the schools would translate into substantial long-run gains.

Had we undertaken policies after *A Nation at Risk* that truly reformed our schools, we could today be enjoying substantially higher national income. Indeed, direct estimates of the lost opportunities suggest that we could today pay for the entire budget for K-12 education from the dividends of effective reform.

Education and Human Capital

Economists have devoted considerable attention to understanding how "human capital" affects a variety of economic outcomes. The underlying notion is that individuals make investment decisions in themselves through schooling and other routes. The accumulated skills that are relevant for the labor market from these investments over time represent the human capital of an individual. The investments made to improve skills then return future economic benefits in much the same way that a firm's investing in a set of machines (physical capital) returns future production and income. In the case of public education, parents and public officials act as trustees for their children in setting many aspects of the investment paths.

In looking at human capital and its implications for future outcomes, economists are frequently agnostic about where these skills come from or how they are produced. Although we return to that below, it is commonly presumed that formal schooling is one of several important

contributors to the skills of an individual and to human capital. It is not the only factor. Parents, individual abilities, and friends undoubtedly contribute. Schools nonetheless have a special place because they are most directly affected by public policies. For this reason, we frequently emphasize the role of schools.

The human capital perspective immediately makes it evident that the real issues are ones of long-run outcomes. Future incomes of individuals are related to their past investments. It is not their income while in school or their income in their first job. Instead, it is their income over the course of their working life.

The distribution of income in the economy similarly involves both the mixture of people in the economy and the pattern of their incomes over their lifetime. Specifically, most measures of how income and well-being vary in the population do not take into account the fact that some of the low-income people have low incomes only because they are just beginning a career. Their lifetime income is likely to be much larger as they age, gain experience, and move up in their firms and career. What is important is that any noticeable effects of the current quality of schooling on the distribution of skills and income will only be realized years in the future, when those currently in school become a significant part of the labor force. In other words, most workers in the economy were educated years and even decades in the past—and they are the ones that have the most impact on current levels of productivity and growth, if for no reason other than that they represent the larger share of active workers.

Much of the early development of empirical work on human capital rightfully concentrated on the role of school attainment, that is, the quantity of schooling. This focus was natural. The revolution in the United States during the twentieth century was universal schooling. Moreover, quantity of schooling is easily measured, and data on years attained, both over time and across individuals, are readily available. Today, however, policy concerns revolve much more around issues of quality than issues of quantity. The completion rates for high school and college have been roughly constant for a quarter of a century. Meanwhile, the standards

movement has focused on what students know as they progress through schools and the knowledge and skills of graduates. It is these attributes that matter in discussions of economic growth.

Individual Productivity and Incomes

It is useful to establish some facts about the value of "quality." One of the challenges in understanding the impact of quality differences in human capital has been simply knowing how to measure quality. Much of the discussion of quality—in part related to new efforts to provide better accountability—has identified cognitive skills as the important dimension. And, while there is ongoing debate about the testing and measurement of these skills, most parents and policy makers alike accept the notion that cognitive skills are a key dimension of schooling outcomes. The question is whether this proxy for school quality—students' performance on standardized tests—is correlated with individuals' performance in the labor market and the economy's ability to grow. Until recently, little comprehensive data have been available to show any relationship between differences in cognitive skills and any related economic outcomes. Such data are now becoming available, so that some of the fundamental questions about quality measurement can be addressed.

There is mounting evidence that quality—generally measured by test scores—is positively related to individual earnings, productivity, and economic growth. While focusing on the estimated returns to years of schooling, early studies of wage determination tended to indicate relatively modest impacts of variations in cognitive ability after holding constant quantity of schooling. More recent direct investigations of cognitive achievement, however, have suggested generally larger labor market returns to measured individual differences in cognitive achievement. A variety of researchers documents that the earnings advantages to higher

achievement on standardized tests are quite substantial.[3] While these analyses emphasize different aspects of individual earnings, they typically find that measured achievement has a direct impact on earnings after allowing for differences in the quantity of schooling, the experiences of workers, and other factors that might also influence earnings. In other words, higher quality as measured by tests similar to those currently being used in accountability systems around the country is closely related to individual productivity and earnings.

Much of the work by economists on differences in worker skills has actually been directed at the issue of determining the average labor market returns to additional schooling. The argument has been that higher-ability students are more likely to continue in schooling. Therefore, part of the higher earnings observed for those with additional schooling really reflects pay for added ability and not for the additional schooling. Economists have pursued a variety of analytical approaches for dealing with this, including adjusting for measured cognitive test scores, but this work generally ignores issues of variation in school quality.[4]

An additional part of the return to school quality does come through continuation in school. There is substantial U.S. evidence that students who do better in school, either through grades or scores on standardized achievement tests, tend to go farther in school.[5] Each of the

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[3]These results are derived from quite different approaches. The clearest analyses are found in the following references (which are analyzed in Hanushek (2002)). See Bishop (1989, 1991); O'Neill (1990); Grogger and Eide (1993); Blackburn and Neumark (1993, 1995); Murnane, Willett, and Levy (1995); Neal and Johnson (1996); Murnane et al. (2000); Altonji and Pierret (2001); and Murnane et al. (2001).

[4] The approaches have included looking for circumstances where the amount of schooling is affected by things other than the student's valuation of continuing and considering the income differences among twins (see Card (1999)). The various adjustments for ability differences typically make small differences on the estimates of the value of schooling, and Heckman and Vytlacil (2001) argue that it is not possible to separate the effects of ability and schooling. The only explicit consideration of school quality typically investigates expenditure and resource differences across schools, but these are known to be poor measures of school quality differences (Hanushek (2002)).

[5] See, for example, Dugan (1976); Manski and Wise (1983)). Rivkin (1995) finds that variations in test scores capture a considerable proportion of the systematic variation in high school completion and in college continuation, so that test score differences can fully explain black-white differences in schooling. Bishop (1991) and Hanushek, Rivkin, and Taylor (1996), in considering the factors that influence school attainment, find that individual achievement scores are highly correlated with continued school attendance. Neal and Johnson (1996) in part use the impact of achievement differences of blacks and whites on school attainment to explain racial differences in incomes. Behrman et al. (1998) find strong achievement effects on both continuation into college and quality of college; moreover, the effects are larger when proper

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available investigations highlights the independent role of achievement in affecting the schooling choices and investment decisions of individuals.

This work has not, however, investigated how achievement affects the ultimate outcomes of higher education. For example, if over time lower-achieving students tend increasingly to attend college, colleges may be forced to offer more remedial courses, and the variation of what students know and can do at the end of college may expand commensurately. This possibility, suggested in *A Nation at Risk*, has not been investigated, but may fit into considerations of the widening of the distribution of income.

The role of schooling and human capital in altering the distribution of incomes in society has received considerable separate attention. The idea of relating distributional outcomes to school quality was a key element of the War on Poverty. It was hoped that through schooling family poverty would not be transferred to the next generation—specifically, that high-quality school investments could overcome deficits originating in the home. Researchers have focused on skill differences as being important in, for example, explaining the patterns of black-white earnings differences or the expansion of earnings differences among people with the same levels of schooling.[6] These analyses have emphasized the growing rewards to skills and have developed the implications of this for wage inequality. Owing to lack of sufficient data over time, they have mostly not looked directly at measured cognitive skills.[7] Nonetheless, building on the findings about individual earnings, it is reasonable to conclude that variations in cognitive skills have a direct impact on variations in the distribution of incomes. As suggested above, variations in the skills of those with similar amounts of schooling—say, completing four years of college—may

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account is taken of the various determinants of achievement. Hanushek and Pace (1995) find that college completion is significantly related to higher test scores at the end of high school.

[6] See, for example, O'Neill (1990); Juhn, Murphy, and Pierce (1991, 1993); Murphy and Welch (1992); Pierce and Welch (1996).

[7] Identifying the changing impact of measured ability on the distribution of outcomes over time is also a very difficult problem, particularly given the structure of available data (see Cawley et al. (2000); Heckman and Vytlacil (2001).

actually be growing over time and may reinforce income differences that come from increased rewards to skills.

This discussion has concentrated on the importance of skill differences, particularly those measured by tests of cognitive knowledge. As such data have become available, research has underscored the importance of skills in determining economic outcomes for individuals. Thus, for the individual, research offers a clear answer to a fundamental question that has recently been voiced: Do differences in observed and measured achievement matter? Yes!

Economic Growth

The relationship between measured labor force quality and economic growth is perhaps even more important than the impact of human capital and school quality on individual productivity and incomes. Economic growth determines how much improvement will occur in the overall standard of living of society. Moreover, the education of each individual has the possibility of making others better off (in addition to the individual benefits just discussed). Specifically, a more educated society may lead to higher rates of invention; may make everybody more productive through the ability of firms to introduce new and better production methods; and may lead to more rapid introduction of new technologies. These "externalities"—influences on others of individual education outcomes—provide extra reason for being concerned about the quality of schooling. Because this is so important and because it has received little attention, we give this feature of the economy the most attention here.

The current economic position of the United States is largely the result of its strong and steady growth over the twentieth century. Strangely, over much of the period after World War II, economists did not pay as much attention to economic growth as they did to macroeconomic fluctuations. In the past 15 years, economists have returned to questions of economic growth.

While a variety of models and ideas have been developed to explain differences in growth rates across countries, they invariably include (but are not limited to) the importance of human capital.[8]

The empirical work supporting growth analyses has emphasized school attainment differences across countries. Again, this is natural because, while compiling comparable data on many things for different countries is difficult, assessing quantity of schooling is more straightforward.

The typical study finds that quantity of schooling is highly related to economic growth rates. But, again, quantity of schooling is a very crude measure of the knowledge and cognitive skills of people. Few people would be willing to assume the amount learned during the sixth grade in a rural hut in a developing country equals that learned in an American sixth grade. Yet that is what is implicitly assumed when empirical analyses focus exclusively on differences in average years of schooling across countries.

Recent work by Dennis Kimko and me goes beyond that and delves into quality of schooling.[9] We incorporate the information about international differences in mathematics and science knowledge that has been developed through testing over the past four decades. And we find a remarkable impact of differences in school quality on economic growth.

In 1963 and 1964, the International Association for the Evaluation of Education al Achievement (IEA) administered the first of a series of mathematics tests to a voluntary group of countries. These assessments were subject to a variety of problems, including: issues of developing an equivalent test across countries with different school structure, curricula, and language; issues of selectivity of the tested populations; and issues of selectivity of the nations that participated. The first tests did not document or even address these issues in any depth. These

[8] Barro and Sala-I-Martin (1995) review recent analyses. Some have questioned the precise role of schooling in growth. Easterly (2002), for example, notes that education without other facilitating factors such as functioning institutions for markets and legal systems may not have much impact. He argues that World Bank investments in schooling for less developed countries that do not ensure that the other attributes of modern economies are in place have been quite unproductive. As discussed below, schooling clearly interacts with other factors, and these other factors have been important in supporting U.S. growth.

tests did, however, prove the feasibility of such testing and set in motion a process to expand and improve on the undertaking.

Subsequent testing, sponsored by the IEA and others, has included both math and science and has expanded on the group of countries that have been tested. In each, the general model has been to develop a common assessment instrument for different age groups of students and to work at obtaining a representative group of students taking the tests. An easy summary of the participating countries and their test performance is found in figure 1. This figure tracks performance aggregated across the age groups and subject area of the various tests and scaled to a common test mean of 50.[10] The United States and the United Kingdom are the only countries to participate in all of the testing. There is some movement across time of country performance on the tests, but for the one country that can be checked—the United States—the pattern is consistent with other data. The National Assessment of Educational Progress (NAEP) in the United States is designed to follow performance of U.S. students for different subjects and ages. NAEP performance over this period shows a sizable dip in the seventies, a period of growth in the eighties, and a leveling off in the nineties. This pattern on the NAEP (see Appendix Figure A1) closely matches the international results and provides support for the validity of the international tests.[11]

Our analysis is very straightforward. We combine all of the available earlier test scores into a single composite measure of quality and consider statistical models that explain differences

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[9] Hanushek and Kimko (2000).

[10] The details of the tests and aggregation can be found in Hanushek and Kimko (2000) and Hanushek and Kim (1995). This figure excludes the earliest administration and runs through the Third International Mathematics and Science Study (TIMSS) (1995). Other international tests have been given and are not included in the figure. First, reading and literacy tests have been given in 1991 and very recently. The difficulty of unbiased testing of reading across languages plus the much greater attention attached to math and science both in the literature on individual earnings and in the theoretical growth literature led to the decision not to include these test results in the empirical analysis. Second, the more recent follow-up to the 1995 TIMSS in math and science is excluded from the figure simply for presentational reasons.

[11] The NAEP tests, like the international tests, consist of a series of separate examinations for different age groups. The NAEP patterns do differ some by age group with younger students showing more improvement than older ones. The same age differences hold in the international examinations, as shown in figure 5 below, and the averaging across age groups buoys up the U.S. position in the aggregations of

Fig. 1. Normalized test scores on mathematics and science examinations, 1970–1995

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in growth rates across nations during the period 1960 to 1990.[12] The basic statistical models, which include the initial level of income, the quantity of schooling, and population growth rates, explain a substantial portion of the variation in economic growth across countries.

Most important, the quality of the labor force as measured by math and science scores is extremely important. One standard deviation difference on test performance is related to 1 percent difference in annual growth rates of gross domestic product (GDP) per capita. Moreover, adding other factors potentially related to growth, including aspects of international trade, private and public investment, and political instability, leaves the effects of labor force quality unchanged.

As shown in figure 2, the implications of such a difference in growth rates are very large. The figure begins with the value of per capita GDP for the United States in the year 2000 and projects its value in 2050 under different growth rates. If the economy grows at 1 percent each year, this measure of U.S. income would increase from $34,950 to $57,480—or more than a 50 percent increase over the period. If it were to grow at 2 percent per year, it would reach $94,000 in 2050. Small differences in growth rates have huge implications for the income and wealth of society. One percent higher growth—say 2 percent versus 1 percent—over a 50-year period yields incomes that are 64 percent higher!

One common concern in analysis such as this is that schooling might not be the actual cause of growth but, in fact, may just reflect other attributes of the economy that are beneficial to growth. For example, as seen in figure 1, the East Asian countries consistently score very highly on the international tests, and they also had extraordinarily high growth over the 1960–1990 period. It may be that other aspects of these East Asian economies have driven their growth and that the statistical analysis of labor force quality simply is picking out these countries. But in fact, even if the East Asian countries are excluded from the analysis, a strong—albeit slightly

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figure 2.

[12] We exclude the two TIMSS tests from 1995 and 1999 because they were taken outside of the analytical period on economic growth. We combine the test measures over the 1965–1991 period into a single measure for each country. The underlying objective is to obtain a measure of quality for the labor force in

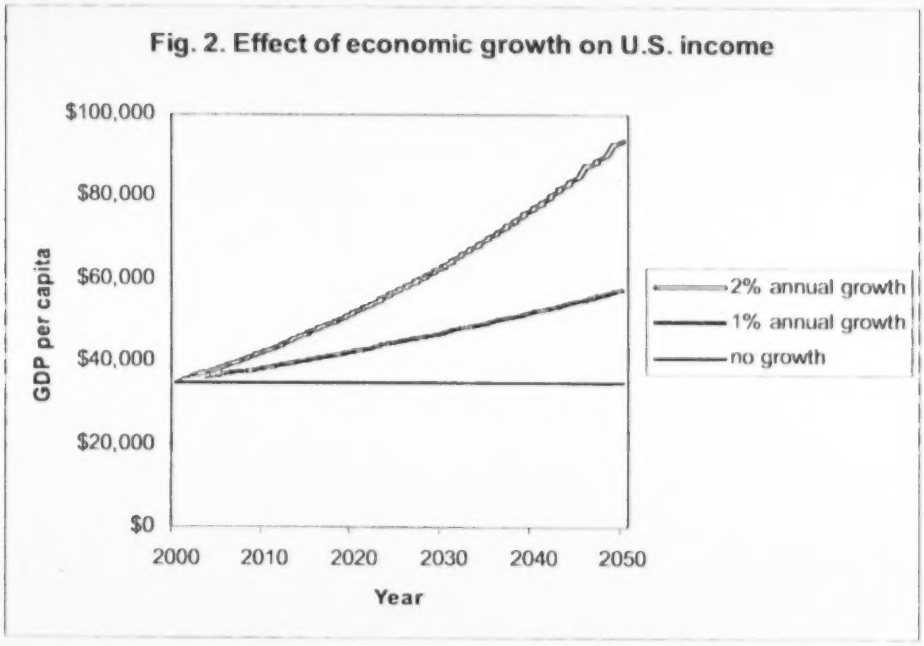
Fig. 2. Effect of economic growth on U.S. income
$100,000
$80,000
$60,000
$40,000
$20,000
$0
GDP per capita
2000
2010
2020
2030
2040
2050
Year
2% annual growth
1% annual growth
no growth

smaller—relationship is still observed with test performance. This test of sensitivity of the results seems to reflect a basic importance of school quality, a factor that contributes also to the observed growth of East Asian countries.

Another concern might be that other factors that affect growth, such as efficient market organizations, are also associated with efficient and productive schools—so that, again, the test measures are really a proxy for other attributes of the country. In order to investigate this, we concentrate on immigrants to the United States who received their education in their home countries. We find that immigrants who were schooled in countries that have higher scores on the international math and science examinations earn more in the United States. This analysis makes allowance for any differences in school attainment, labor market experience, or being native English-language speakers. In other words, skill differences as measured by the international tests are clearly rewarded in the United States labor market, reinforcing the validity of the tests as a measure of individual skills and productivity.

Finally, the observed relationships could simply reflect reverse causality, that is, that countries that are growing rapidly have the resources necessary to improve their schools and that better student performance is the result of growth, not the cause of growth. As a simple test of this, we investigated whether the international math and science test scores were systematically related to the resources devoted to the schools in the years prior to the tests. They were not. If anything, we found relatively better performance in those countries spending less on their schools.

In sum, the relationship between math and science skills on the one hand and productivity and growth on the other comes through clearly when investigated in a systematic manner across countries. This finding underscores the importance of high-quality schooling and leads to a more detailed consideration of the growth of the U.S. economy.

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the period during which growth is measured.

Why Has U.S. Growth Been So Strong?

We started this discussion by recounting America's successful economic growth during the twentieth century. Yet, looking at figure 1, we see that the United States has been at best mediocre in mathematics and science ability. Regardless of the set of countries taking the test, the United States has performed in the middle of the pack or below. Some people find this anomalous. How could math and science ability be important in light of the strong U.S. growth over a long period of time?

The answer is that quality of the labor force is just one aspect of the economy that enters into the determination of growth. A variety of factors clearly contribute, and these factors work to overcome any deficits in quality. These other factors may also be necessary for growth. In other words, simply providing more or higher-quality schooling may yield little in the way of economic growth in the absence of other elements, such as the appropriate market, legal, and governmental institutions to support a functioning modern economy. Past experiences investing in less developed countries that lack these institutional features demonstrates that schooling is not itself a sufficient engine of growth.

Nonetheless, the fact that economic growth has been strong in America is no reason to ignore issues of school quality. Better schools would, by the available evidence, reinforce and amplify the other advantages that have supported the strong and consistent growth of the U.S. economy.

This section describes some of the other contributing factors. It does this in part to understand more fully the character of economic growth, but more important to highlight some issues that are central to thinking about future policies.

Economic Structure

Almost certainly the most important factor sustaining the growth of the U.S. economy is the openness and fluidity of its markets. The United States maintains generally freer labor and

product markets than most countries in the world. The government generally has less regulation on firms (both in terms of labor regulations and in terms of overall production), and trade unions are less extensive than those in many other countries. Even broader, the United States has less intrusion of government in the operation of the economy—not only less regulation but also lower tax rates and minimal government production through nationalized industries. These factors encourage investment, permit the rapid development of new products and activities by firms, and allow U.S. workers to adjust to new opportunities. While identifying the precise importance of these factors is difficult, a variety of analyses suggest that such market differences could be very important explanations for differences in growth rates. [13]

Because of the generally favorable institutional conditions, U.S. growth has been strong, even if some of the underlying factors are not as competitive. In other words, the economic structure can mask problems within the economy. But this does not negate the fact that improving our schools and the quality of our labor force would enhance growth and incomes.

Substitution of Quantity for Quality

Over the twentieth century, the expansion of the education system in the United States outpaced that around the world. The United States pushed to open secondary schools to all citizens. With this came also a move to expand higher education with the development of land grant universities, the G.I. bill, and direct grants and loans to students. In comparison with other nations of the world, the U.S. labor force has been better educated, even after allowing for the lesser achievement of its graduates. In other words, more schooling with less learning each year has yielded more human capital than found in other nations that have less schooling but learn more in each of those years.

This historical approach, however, appears on the verge of reaching its limits. Other nations of the world, both developed and developing, have rapidly expanded their schooling systems, and many now surpass the United States. Figure 3 shows secondary school completion

[13] See, for example, Krueger (1974); World Bank (1993); Parente and Prescott (1994, 1999).

Fig. 3: Secondary school completion rates, 1999
100
80
60
40
20
0
Japan
Slovak Republic
Hungary
Germany
Netherlands
Korea
Denmark
Finland
Ireland
Israel
France
Switzerland
Belgium (Fl.)
Iceland
OECD average
UNITED STATES
Sweden
Italy
Spain
Jordan
Greece
Thailand
Malaysia
Luxembourg
Philippines
Peru
Chile
Czech Republic
India
Brazil
Argentina
China
Tunisia
Indonesia
Mexico
Paraguay

rates for both Organization for Economic Cooperation and Development (OECD) countries and a selection of others in 1999.[14] Remarkably, the United States trailed a large number of other countries in 1999 and falls just slightly below the OECD average completion rate. The United States gains some by having rates of college attendance above the typical OECD country. Nonetheless, as summarized in figure 4, U.S. students are not likely to complete more schooling

The past advantage of the United States in amount of school completed has gone away as other nations have discovered the importance of schooling. Thus, going into the future, the United States appears unlikely to continue dominating others in human capital unless it can improve on the quality dimension.

Quality of U.S. Colleges

The analysis of growth rates across countries emphasizes quality of the elementary and secondary schools of the United States. It did not include any measures of the quality of U.S. colleges. By most evaluations, U.S. colleges and universities rank at the very top in the world. No direct measurements of quality of colleges across countries exist. However, there is indirect evidence. Foreign students by all accounts are not tempted to emigrate to the United States to attend elementary and secondary schools—except perhaps if they see this as a way of gaining entry into the country. They do emigrate in large numbers to attend U.S. colleges and universities. They even tend to pay full, unsubsidized tuitions at U.S. colleges, something that many fewer American citizens do.

A number of the economic models of economic growth in fact emphasize the importance of scientists and engineers as a key ingredient to growth. By these views, the technically trained college students who contribute to invention and to development of new products provide a special element to the growth equation. Here, again, the United States appears to have the best

[14] Data come from the Organization for Economic Cooperation and Development (2001) which has made an effort to use standardized definitions. The non-OECD countries are included in the World Education Indicators project.

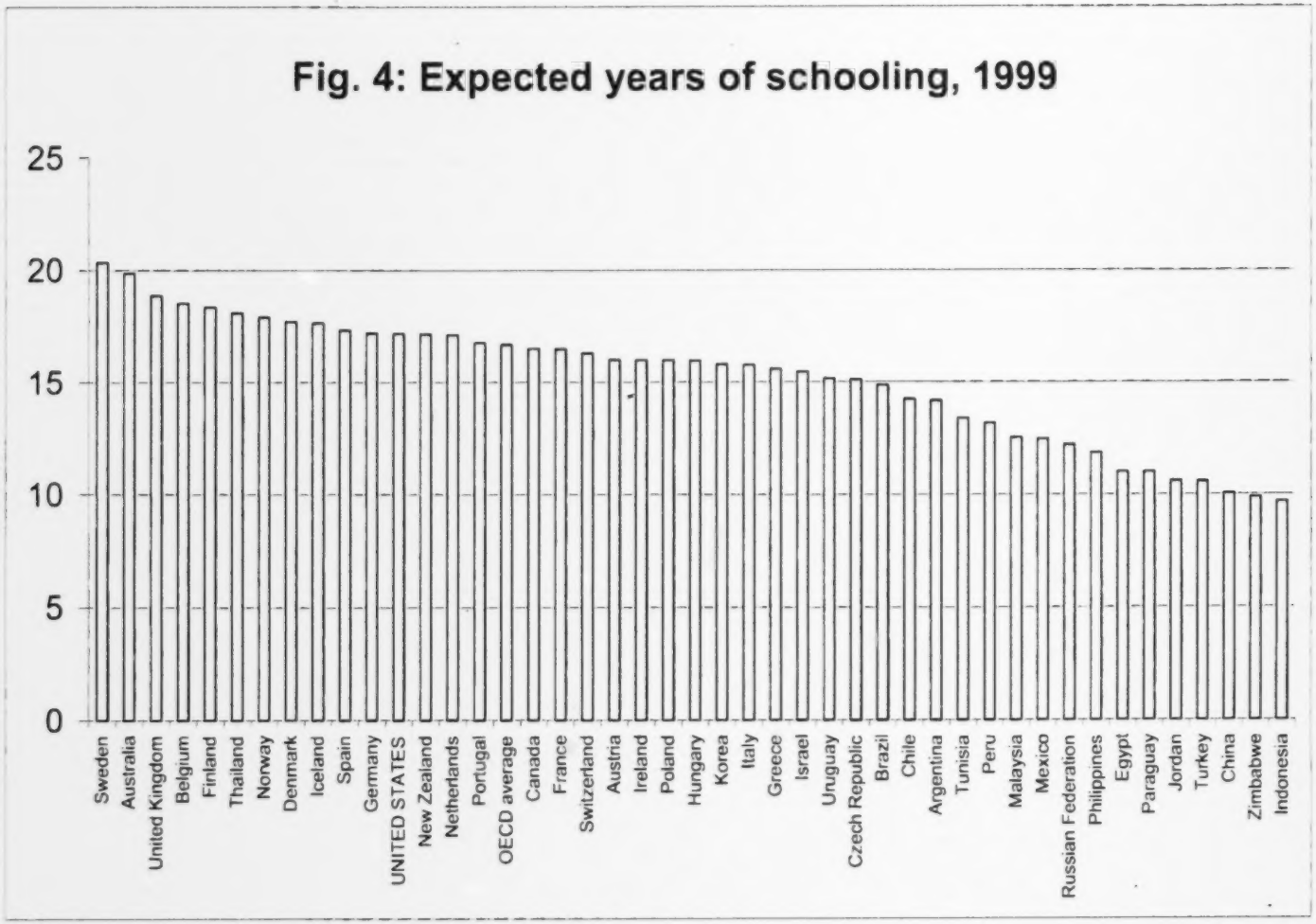
Fig. 4: Expected years of schooling, 1999
25
20
15
10
5
0
Sweden
Australia
United Kingdom
Belgium
Finland
Thailand
Norway
Denmark
Iceland
Spain
Germany
UNITED STATES
New Zealand
Netherlands
Portugal
OECD average
Canada
France
Switzerland
Austria
Ireland
Poland
Hungary
Korea
Italy
Greece
Israel
Uruguay
Czech Republic
Brazil
Chile
Argentina
Tunisia
Peru
Malaysia
Mexico
Russian Federation
Philippines
Egypt
Paraguay
Jordan
Turkey
China
Zimbabwe
Indonesia

programs. If this view is correct, U.S. higher education may continue to provide a noticeable advantage over other countries.

But the raw material for U.S. colleges is the graduates of our elementary and secondary schools. As has been frequently noted, the lack of preparation of our students leads to extensive remedial education at the postsecondary level, detracting from the ability of colleges and universities to be most effective. And, pre-college preparation is likely an important factor driving the increased proportions of foreign born graduates from the science and engineering programs of U.S. colleges and universities.

Interpreting the Evidence on Quality

The measurement of student outcomes has been pulled in two different directions. On the one hand, the movement toward standards and testing has emphasized the need to test student performance and to use information from those tests in judging the accomplishments of both students and schools. On the other hand, a segment of the school policy community has argued against the current testing—either because it does not measure attributes they think are important or because the test outcomes are irrelevant.

One aspect of this discussion is to demonstrate that differences in performance on existing tests have significant implications for both individual and aggregate success. Performance on standardized tests of math and science is directly related to individual productivity and earnings and to national economic growth.

None of this says that the existing tests are the best possible. It just indicates that the existing tests identify something real, something that has important ramifications for individuals and the economy.[15]

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[15] Note, however, that most of the existing analysis has relied on test results in which the scores might be regarded as a reflection of the student's true ability. It goes without saying that if tests were artificially inflated, say, by cheating or emphasizing just the mechanics of test taking, they would not reflect skill differences. In such a case, the relationship between measured scores and economic outcomes might disappear.

Further, just because this dimension is important does not mean that other dimensions could not also be important. In fact, some research suggests that there are other important quality dimensions for individuals.[16] Similarly, to the extent that aggregate growth is fueled by invention, creativity is likely to be important, and this may differ from measured cognitive skills. To be useful, however, these other dimensions must be identified and measured, and thought and analysis must go into determining how these dimensions might be improved. Currently, a variety of people argue that schools do more than produce reading, math, and science skills—which schools undoubtedly do. But such arguments do not deny that cognitive skills are also important. And they do not say what should be done if one wants to enhance these other, currently unmeasured areas.[17]

Finally, this discussion has not pursued the issue of where the measured skills come from. We have learned through extensive research that families, schools, and others contribute to the knowledge of students. The foregoing analysis has simply considered the skills of individuals and how those skills translate into economic outcomes. The issue facing the United States is how to align policies that will enhance those outcomes.

It is interesting in this light that international evidence, like that for the United States, does not show test scores being strongly related to school resources.[18] As mentioned previously, the international math and science scores used in the analysis of growth rates are not related to spending or other measures of school resources, such as pupil-teacher ratios.[19] These statistical results simply reinforce well-known differences, such as the very large class sizes in East Asian

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[16] For example, Murnane et al. (2001).

[17] Bracey (2002) phrases his discussion in terms of "competitiveness," measured by the Current Competitiveness Index developed by the World Economic Forum. He correlates this index with current scores on the TIMSS. The most telling points, he believes, are that TIMSS scores are not perfectly correlated with this index and that the United States ranks highly on the index. He goes on to explain why the United States ranks well on the competitiveness index by essentially the factors discussed for growth rate differences: higher quantity of education, greater college attendance, retaining our scientists and engineers (while attracting foreign immigrants), securing favorable rankings of its economy by international businessmen, and having greater innovative capacity.

[18] For the U.S. evidence on resources, see Hanushek (1997, 1999). International evidence can be found in Hanushek (2003).

countries. Similarly, looking within countries that participated in the 1995 TIMSS, there is no systematic pattern to resource usage within these countries and student performance.[20]

In contrast, a large body of evidence suggests that schools do have a large influence on student outcomes.[21] It is just that high-quality schools are not just those that spend the most or have the smallest class sizes.

One final aspect of U.S. performance is important. U.S. students start out doing well in elementary grades, then fade by the end of high school. Figure 5 shows the slip that occurs over time in comparison with other countries participating in the TIMSS math and science testing. To the extent that performance at the end of secondary schooling is the most important—because it represents the input of college, because it sets the stage for science and engineering skills, or because it is important in its own right for workers in the labor force—schools in the United States are not keeping up in the preparation of students.

The Cost of Not Improving Quality

A Nation at Risk issued a call for improved schooling, but this call went unheeded. To be sure, schools introduced new programs, pursued different visions of improvement, and spent considerably more on schools. But student performance remained essentially flat.

What might have been the effect if schools had improved? Consider a hypothetical scenario where schools instituted truly effective reform in math and science instruction at the time of the *A Nation at Risk* report. Had the reform translated into achievement growth of 0.12 standard deviations per year for the remainder of the decade, scores of graduates would be one standard deviation higher going into the nineties and the future. This would have been Herculean effort but within the bounds of expectations. An improvement of that magnitude would put U.S.

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[19] Hanushek and Kimko (2000).
[20] Hanushek and Luque (2003); Hanushek (2003).

[21] See the review in Hanushek (2002).

Fig. 5. Performance on TIMSS by age groups

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student performance in line with that of students in the United Kingdom and a variety of other European countries, but they still would not be at the top of the world rankings.

Such a path of improvement of course would not have had an immediately discernible effect on the economy, because new graduates are always a small portion of the labor force, but the impact would mount over time. If past relationships between quality and growth held, GDP in the United States would end up more than 4 percent higher than realized in 2002.[22] With close to a $10.5 trillion economy, the unrealized gain for 2002 alone would amount to $450 billion, or more than the total annual expenditure on K–12 education.

Unfortunately, we have increased spending on schools for the two decades since *A Nation at Risk*, but we have failed to get the desired improvement in outcomes, and our economy – while strong – has not met its potential.

Conclusions

In February 1990, in an unprecedented meeting of the nation's governors with President George H. Bush, an ambitious set of goals was set for America's schools. Goal Number 4 was that by 2000, "U.S. students will be first in the world in mathematics and science achievement." By 1997, as it was evident that this goal was not going to be met, President Clinton, in his State of the Union speech, returned to the old model of substituting quantity for quality: "We must make the thirteenth and fourteenth years of education—at least two years of college—just as universal in America by the twenty-first century as a high school education is today."[23] The quality goal, while perhaps more difficult to meet, appears to be a better approach than reverting to our past practice of emphasizing just quantity of schooling.

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[22] These calculations assume that math and science performance of graduates improves steadily through the eighties until it is one standard deviation higher in 1990 than in 1982. After 1990, performance stays at this higher level. These changes then affect the labor force quality according to the proportion of the total labor force with higher achievement (that is, high achievers steadily become an increasing portion of the labor force over time). The growth rates implied from Hanushek and Kimko (2000) are then compounded over the entire period, based on the average performance of the labor force during each of the intervening years.
[23] Clinton (1997).

A variety of commentators, dead set against any fundamental changes in the nation's schools, rely on a combination of simplistic arguments: The poor performance of U.S. students does not matter because the tests are not valid; we could improve our scores if only we devote more resources to our public schools; schools cannot be expected to deal with the problems of learning that emanate from the home. Gerald Bracey goes one step further.[24] He ends his discussion of how competitiveness of economies is uncorrelated with student performance by warning that innovation may be inversely related to student achievement: "We should think more than twice before we tinker too much with an educational system that encourages questioning. We won't benefit from one that idolizes high test scores. It could put our very competitiveness as a nation at risk." No evidence is presented, however, to demonstrate that creativity is lessened by improving the mathematics and scientific skills of students. Nor does he speak to the costs placed on those individuals who neither reap rewards for exceptional creativity nor have the skills necessary to perform in the modern economy.

Research underscores the long-run importance of high achievement of our students and our future labor force. Higher achievement is associated both with greater individual productivity and earnings and with faster growth of the nation's economy. It no longer appears wise or even feasible to rely on more years of low-quality schooling.

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[24] Bracey (2002).

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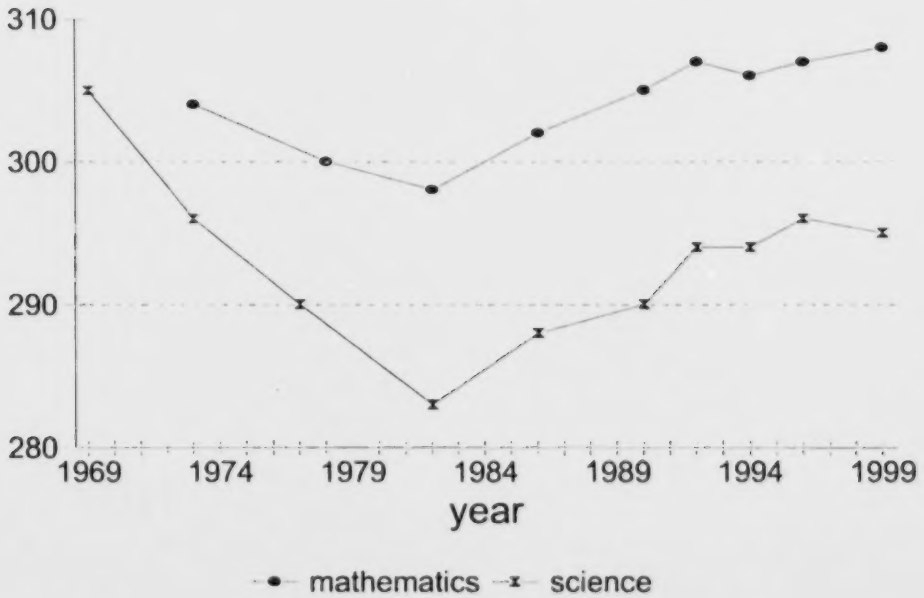
Figure A1. National Assessment of Educational Progress (NAEP), age 17



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